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Most of the freight cars of the Ukrainian railways are equipped with three-piece trucks. One of the key parameters that characterize the technical state of a car is the center plate arrangement wear, which increases impact forces at start from rest and in braking, impairs longitudinal force transfer through the pivot, causes pivot bending, shearing, etc.

For a detailed study of the interaction and wear of the center plate arrangement components and their effect on the dynamic performance of a car, account must be taken of the spatial oscillations of its structural components caused not only by disturbances from the track, but also by its longitudinal dynamics involving the action of forces from the adjacent cars, braking forces, and other longitudinal forces.

The aim of this work was to develop a mathematical model of the oscillations of a group of cars coupled by

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elastodissipative links with proper consideration for the features of the contact between the components of the carbody-on-trucks resting system for the prediction of the processes of their interaction and the center plate arrangement wear. Use was made of methods of mathematical simulation, numerical integration, oscillation theory, and statistical dynamics.

In the model, all the cars except for the middle one are described as rigid bodies that oscillate in a longitudinal vertical plane. The middle car is described by a spatial model that takes proper account of the interaction between the components of the carbody-on-trucks resting system and the design features of standard and comprehensively retrofitted trucks.

The center plate and center bowl work surface interaction and wear processes are analyzed for the case of hoppers with standard and comprehensively retrofitted trucks. The effect of the more accurate simulation of the interaction between the center plate arrangement components on the calculated dynamic car performance is estimated. It is shown that at increased speeds of a car the calculated values of its horizontal dynamic indices are higher in the case where a single-car model is used.

В модели все вагоны, кроме среднего, описаны как жесткие тела, колеблющиеся в продольной вертикальной плоскости. Средний вагон описан пространственной моделью, учитывающей взаимодействие между компонентами системы вагон-тележка и конструктивные особенности стандартных и комплексно переоборудованных тележек.

Процессы взаимодействия поверхности рабочих поверхностей центрального бруса и центрального чашки и износа анализируются для случая вагонов со стандартными и комплексно переоборудованными тележками. Эффект более точного моделирования взаимодействия между компонентами системы центрального бруса на расчетные динамические показатели подвижного состава оценивается. Показано, что при увеличении скорости вагона расчетные значения его горизонтальных динамических показателей выше в том случае, когда используется модель одного вагона.

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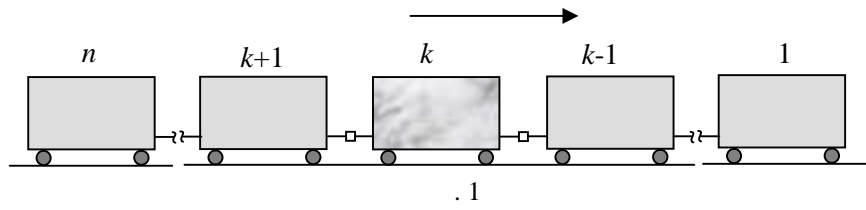
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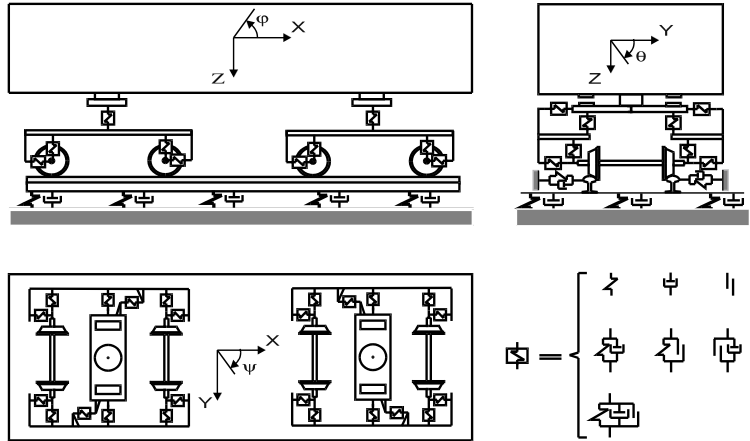
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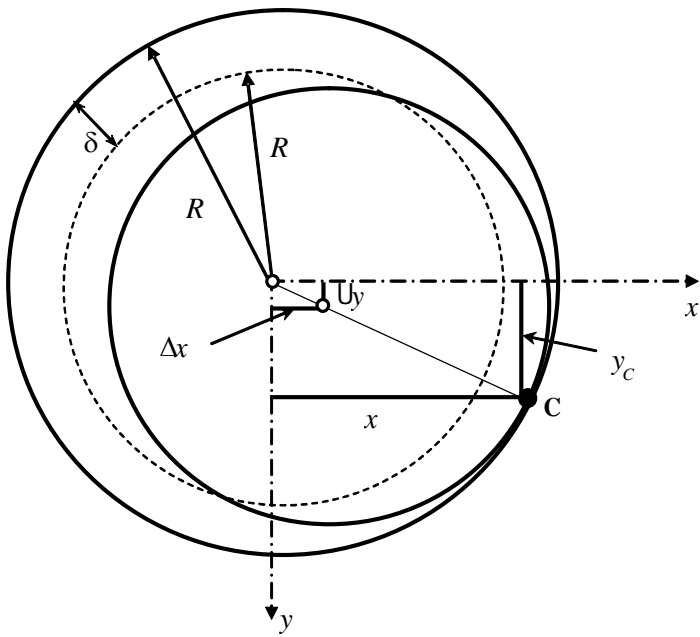


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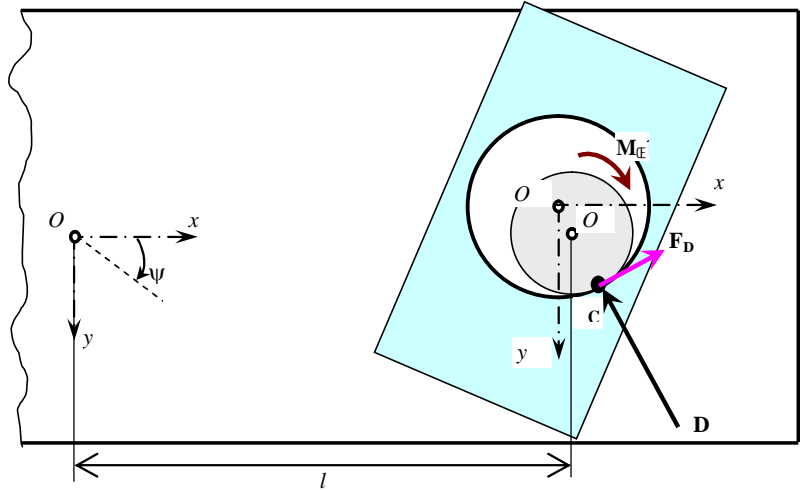
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$$m_i \ddot{x}_i = S_i - S_{i+1} + E_i, \quad (i = 1, 2, \dots, k-1, k+1, \dots, n),$$

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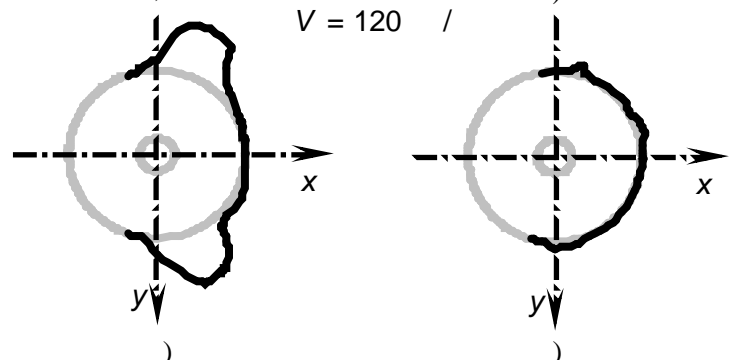
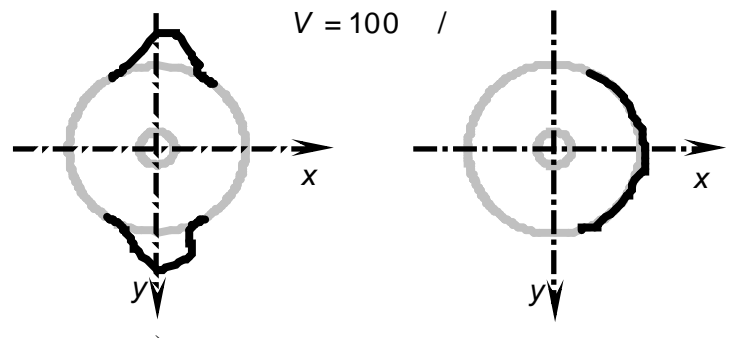
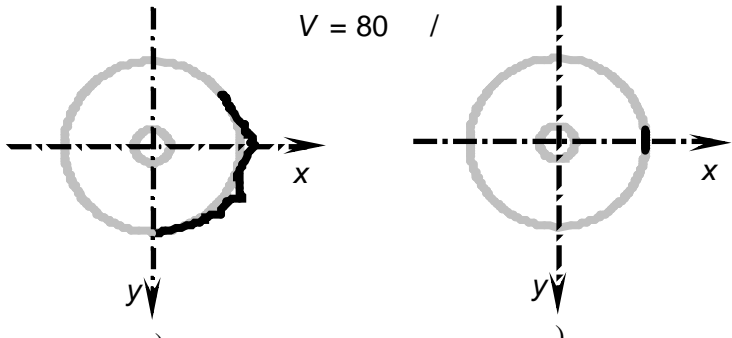
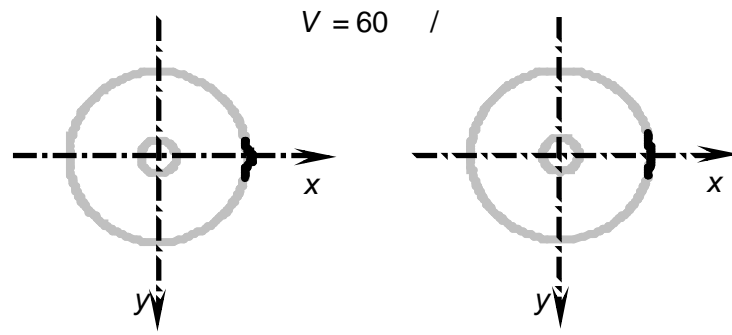
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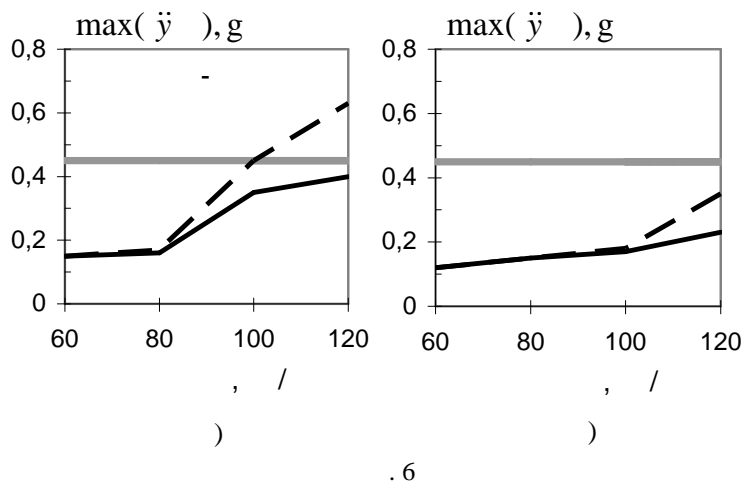
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 20.12.2018